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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,535	03/01/2004	Michael B. Korzenski	ATMI-692	4252

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MOORE & VAN ALLEN PLLC
P.O. BOX 13706
Research Triangle Park, NC 27709

EXAMINER

DOUYON, LORNA M

ART UNIT	PAPER NUMBER
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1751

DATE MAILED: 05/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/790,535

Applicant(s)

KORZENSKI ET AL.

Examiner

Lorna M. Douyon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 March 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15, 20-40, 46-56, 58 and 59 is/are rejected.
- 7) ☒ Claim(s) 16-19, 41-45 and 57 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6/7/04; 3/16/06</u> . | 6) <input type="checkbox"/> Other: _____ |

Claim Rejections - 35 USC § 112

1. Claim 12 and 38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 12 and 38 some members of the Markush language are not nonionic surfactants namely: polyethylene glycols, polypropylene glycols, carboxylic acid salts, dodecylbenzenesulfonic acid, dodecylbenzenesulfonic salts, polyacrylate polymers, acetylenic diols, modified acetylenic diols, alkylammonium salts and modified alkylammonium salts.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4, 7-10, 15, 20, 25-28, 30, 32-36, 40, 49-52 are rejected under 35 U.S.C. 102(b) as being anticipated by Mullee et al. (US Patent No. 6,500,605), hereinafter “Mullee ‘605”.

Mullee ‘605 teaches a method of removing photoresist and residue from a wafer following a medium dose ion implant wherein the method begins by maintaining supercritical carbon dioxide, a solvent and aqueous fluoride in contact with the wafer (see col. 4, lines 34-38;

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62-64), wherein the solvent used were BLO (butyrolactone), DMSO (dimethyl sulfoxide) and glacial acetic acid (which also reads on both the surface passivator and binder), and additional water and the aqueous fluoride was aqueous ammonium fluoride (see col. 11, lines 25-34). The residue includes SiO₂ etch residue or SiN etch residue (see col. 3, lines 15-19). The pressure chamber was maintained at 70°C, the aqueous fluoride and solvent were circulated for 2 minutes at 1,250 psi after which the pressure chamber was pressurized to 2,800 psi, and two partial exhausts and one full exhaust were employed between the removal and rinse step (see col. 11, lines 25-49). Mullee '605 teaches the limitations of the instant claims. Hence, Mullee '605 anticipates the claims.

4. Claim 55 is rejected under 35 U.S.C. 102(e) as being anticipated by DeYoung et al. (US Patent No. 6,669,785), hereinafter "DeYoung".

DeYoung teaches a fluid composition useful for cleaning a microelectronic substrate comprising from 0.0001, 0.0005 to 5, 10 or 20 percent by weight of an adduct of hydrogen fluoride and a Lewis base; and from 40 or 50 to 99.999 percent by weight of liquid or supercritical carbon dioxide, wherein the composition is aqueous or nonaqueous, and the composition may further comprise from 0.001 or 0.1 percent to 30 or 40 percent by weight of a cosolvent, and/or from 0.001 to 1, 3 or 5 percent by weight of a surfactant (see col. 2, lines 41-54). DeYoung teaches the limitations of the instant claim. Hence, DeYoung anticipates the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 29, 56, 58 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee '605 as applied to the above claims.

Mullee '605 teaches the features as described above. Mullee '605, however, fails to specifically disclose a contacting time in the range from about 4 minutes to about 20 minutes, and pre-cleaning the wafer surface with a SCF-based pre-cleaning composition comprising SCF and an aqueous-based pre-cleaning formulation.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to reasonably expect the contacting time of the composition of Mullee '605 to be

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within those recited because the term “about” permits some tolerance, hence, the lower limit of “about 4 minutes” of the present claim may be considered to read on the 2 minutes circulation time in the teachings of Mullee ‘605 in col. 11, line 35, and to reasonably expect the cleaning method of Mullee ‘605 to read on the pre-cleaning step as well, because a repetition of step is within the level of ordinary skill in the art.

8. Claims 5-6 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee ‘605 as applied to the above claims, and further in view of Mullee (US Patent No. 6,306,564), hereinafter “Mullee '564”.

Mullee ‘605 teaches the features as described above. Mullee ‘605, however, fails to disclose a solvent which comprises C1-C6 alcohol, preferably methanol.

Mullee '564 teaches the equivalency of dimethyl sulfoxide (DMSO) with propanol, ethanol and methanol as organic solvents in a similar composition using supercritical carbon dioxide for removing resist or residue from semiconductors (see col. 4, lines 24-27).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the DMSO solvent in the composition of Mullee ‘605 with methanol because the substitution of art recognized equivalents as shown by Mullee '564 is within the level of ordinary skill in the art.

9. Claims 11, 13, 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee ‘605 as applied to the above claims, and further in view of Douglas et al. (US Patent No. 5,868,862), hereinafter “Douglas”.

Mullee '605 teaches the features as described above. Mullee '605, however, fails to disclose incorporating into the composition a surfactant such as an anionic surfactant like sodium alkyl sulfates.

Douglas teaches the incorporation of surfactants such as anionic surfactant like sodium dodecyl sulfate into a similar composition comprising supercritical carbon dioxide for removing contaminants overlaying a substrate (see col. 5, lines 37-40).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate anionic surfactant like sodium dodecyl sulfate into the composition of Mullee because such incorporation would provide increased effectiveness in the removal of contaminants overlaying a substrate as taught by Douglas.

10. Claims 12, 14 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee '605 as applied to the above claims, and further in view of Douglas, and further in view of Jureller et al. (US Patent No. 5,676,705), hereinafter "Jureller".

Mullee '605 and Douglas teach the features as described above. In addition, Douglas teaches that the surfactants can be cationic, anionic, nonionic or zwitterionic surfactants (see col. 5, lines 37-39). The combination of reference, however, fails to specifically disclose ethoxylated fluorosurfactants as the specific nonionic surfactants.

It is known from Jureller that ethoxylated fluorosurfactants are effective surfactants for use in supercritical fluid carbon dioxide (see col. 2, lines 11-12; col. 2, lines 32-37; col. 6, line 28+).

It would have been obvious to one of ordinary skill in the art at the time the invention

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was made to have incorporated ethoxylated fluorosurfactants as the specific nonionic surfactants into the composition because Douglas specifically desires a surfactant, the nonionic surfactant being one selection and Jureller teaches that ethoxylated fluorosurfactants, which are nonionic surfactants, are effective surfactants for use in supercritical fluid carbon dioxide.

11. Claims 1-13, 15, 20-21, 23-33, 35-40, 46, 48, 51-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joyce et al. (US Patent No. 6,764,552), hereinafter "Joyce".

Joyce teaches a supercritical cleaning solution which includes supercritical carbon dioxide with a fluoride source, preferably hydrogen fluoride or ammonium fluoride, wherein the fluoride has a final concentration in the supercritical solution of between about 0.1 and 2% by weight, and up to about 20% by weight, preferably between about 2 and 10 percent by weight co-solvents like alcohols like methanol, ethers and water (see col. 13, lines 11-29; col. 7, lines 17-52; col. 9, lines 18-20). The supercritical solution may include up to about 15% by weight, preferably between about 0.1 and 2% by weight chelating agent like EDTA, up to about 5% by weight anti-corrosion agent (wherein both can read on surface passivator), and further includes up to about 50%, preferably between about 0.1 and 30% by weight of a surfactants like anionic, cationic or neutral surfactants, for example, amphiphilic fluoropolymers (see col. 13, lines 35-49; col. 9, lines 57-61; col. 10, lines 22-26; 45-53). The waste products which may be cleaned using supercritical solutions include metal residues like metal residues of nitrides and silicon dioxide (see col. 4, lines 24-34). The supercritical solution can also include ammonium hydroxide (see col. 6, lines 24-28). The supercritical solution also comprises swelling agents which include tertiary amines like triethanolamine (equivalent to binder) and these tertiary amines tend to break

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bonds in polymeric photoresists (see col. 8, lines 14-20) in a concentration range between about 0.1 and 15% by weight (see col. 9, lines 23-29). In the method of cleaning a wafer in a cleaning chamber with the supercritical cleaning solution, the temperature within the chamber is maintained at between about 50°C and 150°C, more preferably about 70°C, and preferably the contact time with at least one surface of the wafer is maintained for a period of between about 1 and 60 minutes, more preferably between about 5 and 20 minutes (see col. 13, lines 30-34; col. 11, lines 44-50). After treatment of the wafer with the supercritical solution, preferred methods further include rinsing the semiconductor with at least one of deionized water, an organic solvent, the supercritical solvent, and mixtures thereof (see col. 11, lines 53-57). Joyce, however, fails to disclose a composition comprising a supercritical fluid, at least one cosolvent, at least one etchant species, at least one surface passivator, a binder, deionized water, and optionally at least one surfactant.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare a composition comprising supercritical carbon dioxide, at least one solvent like ethanol and water, ammonium fluoride, triethanolamine (equivalent to binder), chelating agent (equivalent to passivator) and surfactant because the teachings of Joyce encompass these ingredients.

12. Claims 1-13, 21-39, 46-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Korzenski et al. (US Patent No. 6,943,139), hereinafter "Korzenski" in view of Mullee '605.

Korzenski teaches a particle contamination cleaning composition useful in semiconductor manufacturing for the removal of particle contamination from patterned silicon/silicon dioxide

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substrates having such particle contamination thereon (see col. 1, lines 8-14) comprising supercritical CO₂ (SCCO₂), alcohol, fluorine source and optionally, hydroxyl additive, and in one aspect the composition comprises SCCO₂, methanol, ammonium fluoride, fluorinated surfactant, and boric acid, wherein methanol is present at a concentration of from about 5 to about 20 wt%, fluoride is present at a concentration of from about 0.01 to about 2.0 wt%, and boric acid is present at a concentration of from about 0.01 to about 2.0 wt%, based on the total weight of the cleaning composition (see col. 1, line 59 to col. 2, line 3). The cleaning composition can be employed to contact a substrate having particulate contamination thereon at a pressure in a range of from about 1000 to about 7500 psi for sufficient time to effect the desired removal of the particulate contamination from the substrate, e.g., for a contacting time in range of from about 5 to about 30 minutes and a temperature of from about 35 to about 100°C (see col. 3, line 62 to col. 4, line 4). In one embodiment, especially high removal of SiN particles from an Si/SiO₂ substrate was achieved by SCCO₂/alcohol (15 wt%)/fluoride (0.55 wt%) solutions at a temperature and pressure of 55°C and 4000 psi, respectively, using a processing time of 30 minutes (10 minute dynamic flow, 10 minute static soak, 10 minute dynamic flow, followed by a three volume SCCO₂/methanol (20 wt%) rinse and pure three volume SCCO₂ rinse), see col. 4, lines 5-12. The dynamic flow and static soak steps may be carried out alternatingly and repetitively (see col. 4, lines 13-20). Following the contacting of the cleaning composition with the substrate bearing the particulate contamination, the substrate thereafter preferably is washed with copious amounts of SCCO₂/alcohol solution, e.g., 20% methanol solution, in a first washing step, to remove any residual precipitated chemical additives from the substrate region in which removal of particulate contamination has been effected, and finally with copious amounts of pure

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SCCO₂, in a second washing step, to remove any residual alcohol co-solvent and/or precipitated chemical additives from the substrate region (see col. 4, lines 26-40). Korzenski, however, fails to specifically disclose a binder interactive with the silicon-containing particulate material to enhance removal thereof and water.

Mullee '605 teaches the features as described above. In particular, Mullee '605 teaches a method of removing photoresist and residue from a wafer following a medium dose ion implant wherein the method begins by maintaining supercritical carbon dioxide, a solvent and aqueous fluoride in contact with the wafer (see col. 4, lines 34-38; 62-64), wherein the solvent used were BLO (butyrolactone), DMSO (dimethyl sulfoxide) and glacial acetic acid (which also reads on both the surface passivator and binder), and additional water and the aqueous fluoride was aqueous ammonium fluoride (see col. 11, lines 25-34).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a binder like glacial acetic acid and water into the composition of Korzenski because such incorporation would provide effective removal of residue from a wafer as taught by Mullee '605.

Allowable Subject Matter

13. Claims 16-19, 41-45 and 57 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: None of the prior art of record, teaches, discloses or suggests a composition or method as those recited wherein the binder comprises polymeric

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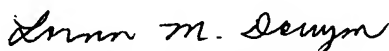
alcohol or polymeric amine, or a method as required in claim 57 wherein the pre-cleaning formulation comprises ammonium hydroxide, t-butyl hydrogen peroxide and water.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lorna M. Douyon whose telephone number is (571) 272-1313. The examiner can normally be reached on Mondays-Fridays from 8:00AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Douglas McGinty can be reached on (571) 272-1029. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Lorna M. Douyon
Primary Examiner
Art Unit 1751